THE MANUFACTURE OF PAINTS.

By W. R. Bradshaw.

THE manufacture of paiuts is a business that has grown from very small beginnings to its present immense proportions, and is one of the most important of commercial enterprises. So great has the business in paints become that the larger paint mills have grown to mammoth establishments, capable of turning out enough paint in one day of ten hours to paint five hundred good sized dwelling-houses. This, multiplied by the number of days in the year, means an immense output, and still the paint mills find no limit to the business. In a properly equipped establishment there are a great many departments necessary for manufacturing paint in large quantities, and unless the business were done on a gigantic scale there would be no profit in it, so keen is the force of competition.

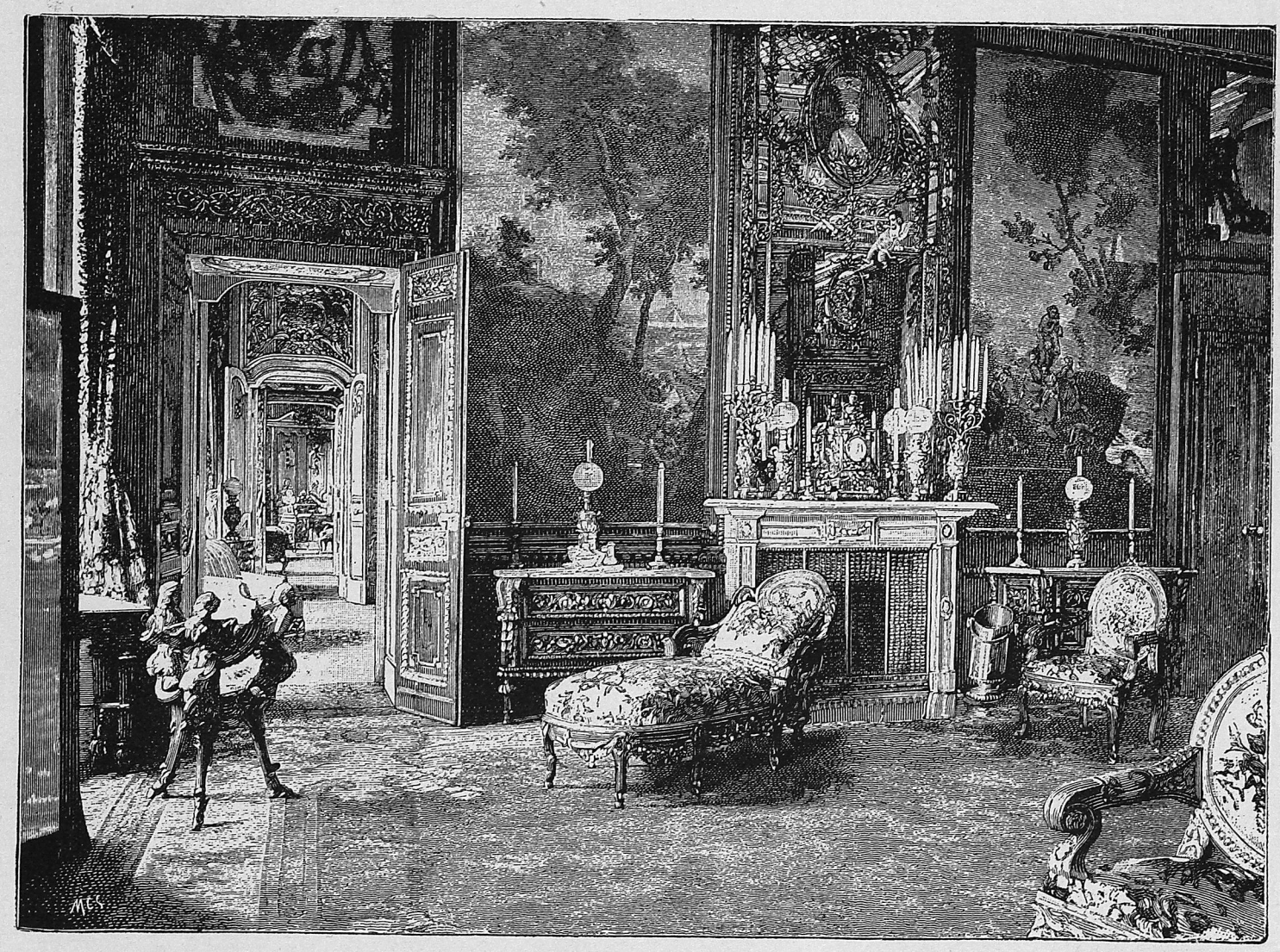
White lead is one of the most important ingredients used in paint manufacture. It is on record as having been used in the time of Christ for painting ships. The first described process for making white lead is the same process that is used nowadays. The lead was formerly steeped in vinegar and buried in a dung-heap for forty days, after which it became carbonate of lead, or the white lead of the painter. The first mention made of the method of using white lead ground in linseed oil, is in a Latin book written 1200 years ago. The author states that the white lead should be mixed with linseed oil, and laid on with a brush of asses' hair. Seven hundred years ago white lead was cheap, and could be bought for three cents a pound. The early painters made a great secret of the manufacture of white lead, which is in reality a very simple process. The pure metallic lead is first cast in buckles and put into earthen pots, after which a pint of dilute acetic acid is put into each pot. A layer of pots is put into a bin and covered with spent tanbark, on the top of which another layer of pots is placed, with more tanbark, etc., until the pile is ten bins high, and contains ten tons of metal. The pile remains untouched for 100 or 120 days, during which time a chemical action sets in between the acetic acid, the lead and the carbonic acid generated from the spent tanbark. The lead becomes corroded into white carbonate of lead, which is the result of the chemical combination of the carbonic acid from the tanbark with the metallic lead. The white lead is subsequently ground into white lead powder, and this, mixed with ten per cent. of linseed oil, forms the ordinary white lead of the painter. Fortunes have been spent in trying to discover a plan of hastening the corroding of the lead, as it is a very expensive process, requiring from three to four months at a time, but all the processes hitherto discovered have failed because the lead hasn't the body of lead made by the old Dutch method.

Litharge is an oxide of lead and is obtained by heating molten lead in a reverberatory furnace. The lead in its heated state rapidly unites the oxygen, and becomes scaled over with flakes of litharge, which on being cooled and ground up form litharge. Red lead is obtained by still further heating litharge until it absorbs a still greater quantity of oxygen, which rusts or reddens the litharge still more.

The ancients were not aware of the properties of zinc for painting purposes. Zinc white, or the oxide of zinc, was known as "philosopher's wool." About a hundred years ago the interior of a French man-of-war was painted with zinc white mixed with oil, and this is the first case on record where zinc was used in lieu of white lead. The oxide of zinc is prepared from metallic zinc, which is put into retorts and heated to a white heat. The vapor of zinc, rising from the heated metal, unites chemically with the oxygen of the air, and the result is dense white fumes which are zinc oxide. In Europe only metallic zinc is vaporized, but in America the zinc ore itself is roasted to form zinc white.

In the manufacture of chrome yellow the metal chromium is treated with potash to form bi-chromate of potash. Chromium is obtained, amongst other places, from a mine of chrome iron ore in Maryland. The bi chromate of potash is dissolved in vats containing either the acetate or nitrate of lead, thousands of gallons of the compound being treated at the same time. The chemical result is the chromate of lead or chrome yellow, a fine light orange pigment. To get the deep orange yellow the addition of lime withdraws only half of the acid, and the basic chromate of lead is the result. To form the lighter shades of yellow varying proportions of the sulphate of lead, and in some cases alum, is added, until the palest lemon yellows are produced.

Prussian blue was discovered in 1710 by a German painter. It is obtained from the yellow prussiate of potash, a substance obtained from the boiling and digesting of blood, hair and other



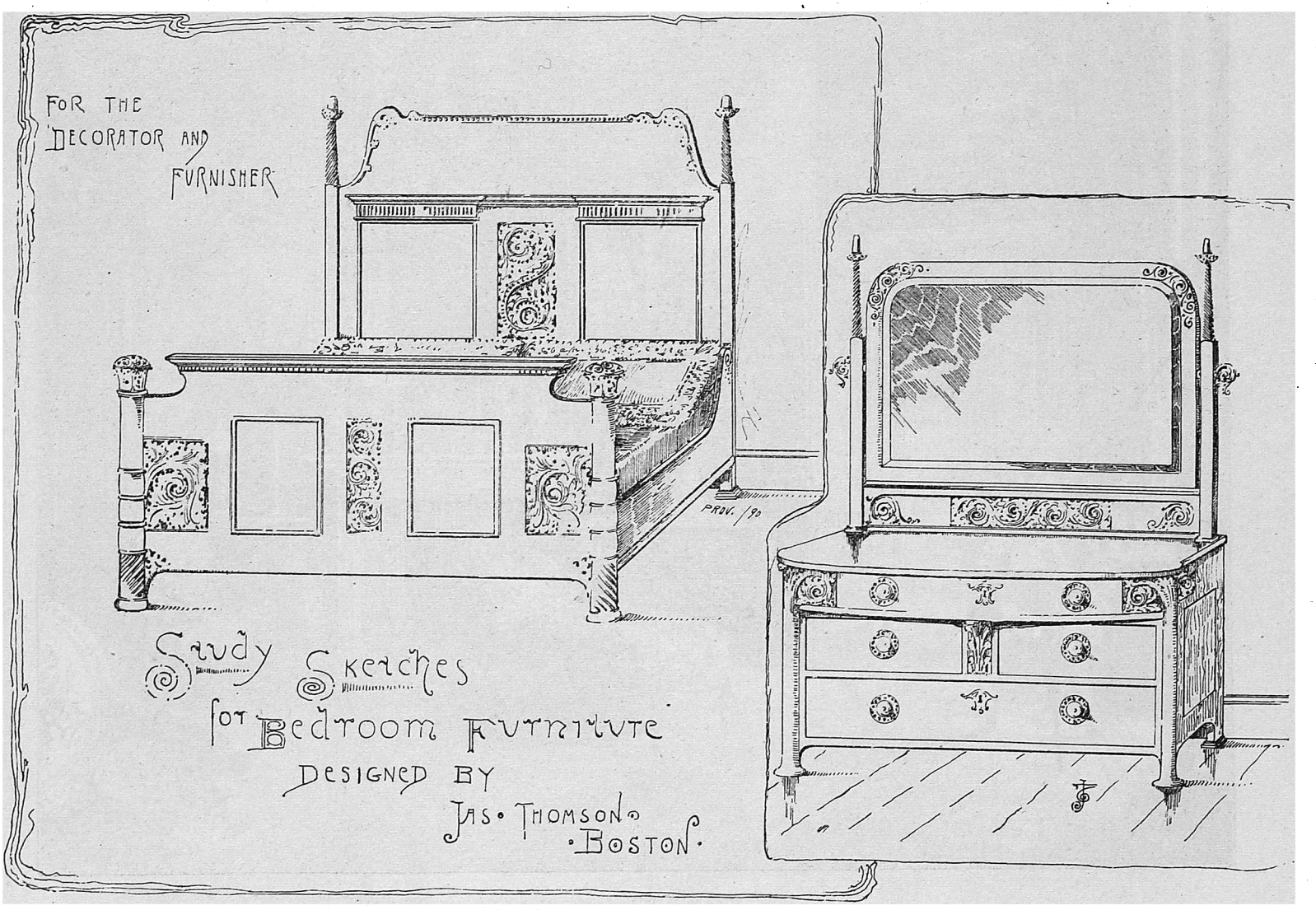
Salon in the King of Italy's Palace at Monza.

animal substances. The prussiate of potash is treated with sulphate of iron, known as blue vitriol. and the result is the Prussian blue of commerce.

Indian red is obtained by roasting the sulphate of iron. The heat drives off the sulphuric acid, and oxygen taking its place turns the iron an Indian red color, which is simply an artificial iron rust. Venetian red is the oxide of iron treated with lime, or in other words, is adulterated Indian red. The siennas, umbers and ochres form a large class of paints and are all natural oxides of iron. They are dug out of the earth like clay and are all largely composed of ferric oxide. Raw sienna and raw umber are simply the natural earths used without any special treatment. To obtain the darker shades of these colors the earths are roasted, hence burnt umber and burnt sienna are darker shades of these pigments. Vandyke brown, otherwise known as Cassel earth, is simply decomposed peat which is formed by the natural rotting of vegetable fibres in the earth. This pigment, if heated, will disappear in smoke, leaving only a residue of white ashes. Ultramarine blue is the most costly and enduring of all pigments. The real pigment is made from *lapis lazuli*, a coarse specimen of precious stone richly veined and spotted with a deep blue color, one pound of which costs $250. The stone is heated in a furnace, plunged into water and broken up. All the blue parts are carefully picked out by hand and ground to a

Verdigras results in the action of copper and vinegar. Strips of copper are suspended in vinegar and the green deposit is subsequently scraped off. The various blues, excepting ultramarine and Prussian blue and indigo, are made from the sulphate of iron, that is copperas, and ferro cyanide of potassium, or yellow prussiate of potash. These substances are first separately dissolved and then run together forming a white precipitate, which, when oxidized by nitric acid or chlorate of potash, forms a deep, dense blue, from which all shades are obtained by simpler manipulations. The green tints are produced by a simple mixture of chrome yellows with the various blues made by the above process.

The Lakes are pigments either of animal or vegetable origin. Logwood boiled in water gives a clear red dye without body. The dye is mixed with clay, or whiting, which, absorbing the coloring matter, becomes the pigments known as rose lake and rose pink. Logwood from Campeche and Logona gives a series of beautiful blacks, purples and browns. The extract of Hypernic wood yields a bright maroon. Brazil wood yields a deep maroon color and fustic chips of bright yellow. Quercitron bark yields more coloring matter to the pound than fustic chips or madder, or any other known vegetable substance. The bark comes packed in bags from Virginia, where the tree grows in forests and is worth $25 a ton when carefully selected. Yellow lake is obtained from the yellow coloring properties of quercitron bark. It is



powder. This pigment, however, was too costly for commercial use, and hence chemists began to investigate mixtures of cheaper substances to produce a similar pigment for commercial purposes. After a long series of interesting investigations, it was discovered that a mechanical mixture of powdered clay, soda, sulphur and rosin, substances whose colors are as far removed as possible from anything approaching a blue tint, would, when melted in a furnace, produce a grayish blue pigment. These substances heated a second time with a further addition of sulphur, produced a beautiful ultramarine blue pigment. It is not known just how these substances in chemical union will produce ultramarine blue, and scientific theories have exhausted themselves to account for the color.

Lamp black is a carbon obtained from the burning of various substances rich in that element. Gas black is obtained from the condensation of burning gas on the sides of metal cylinders. Ivory black is obtained from calcined bones ground into an impalpable powder. This bone dust is subsequently ground in water forming a black paste. Drop black is simply ivory black ground in oil, which drops from the mill in a viscid mass.

Paris green is a chemical mixture of arsenic and sal-soda.

first digested in a boiler containing a ton or more of this shredded bark, and after ten hours boiling the yellow coloring matter is drawn off into a large vat. The fluid is first oxidized with chloride of potash, and then precipitated with stannous chloride, or chloride of tin, these forming the color known as yellow lake.

The pigment known as carmine is obtained from the cochineal bug. These insects breed in large quantities on the prickly pear cactus in Mexico, covering the plant with a bluish gray mold. A cochineal farm is worth from $250 to $500 an acre, according ty its capacity for raising the insects. A single leaf will afford nourishment to thousands of the bugs. A mother insect is first put on each leaf, and in a short time the leaf is found covered with minute insects, each fixed thereto by a sucker. The male insect has wings and contrives to get away as soon as he is able to fly. Thus the female insect alone is sacrificed to commerce. As soon as the insects are fully developed they are scraped off the cactus and quickly killed by being dried in the sun. It takes 70,000 insects to weigh a pound. Indigo is obtained from the indigo plant that flourishes in India and elsewhere and is so well known as to require no description. Indian yellow is a strange substance which is brought by the country natives in

India into the cities for sale. It is stated that the balls are made of earth dug from the floors of camels' stables. Gamboge is made from the gum of a tree in Siam. The fluid yellow juice is caught in the hollow stocks of the bamboo where it hardens into a solid mass. Terra Vert is a green ochre. The best of all ochres is yellow ochre from Oxford, England. It possesses a very fine yellow tint and is extremely fine and smooth to the touch, resembling soapstone. Mummy is a bituminous earth exported frow the tombs of Egypt. It is carefully mixed with mummy dust, and now and again stray bones of the departed are discovered among the yellow dust.

In addition to paints adapted for house, coach and fresco painting some factories make a specialty of producing a variety of tints chiefly for the use of wall paper manufacturers. It being impossible to obtain the ultra aesthetic shades by the processes

GAME PLATE IN REPOUSSE—No. 6 of the Series—BY LILY MARSHALL.

already referred to, recourse is made to the aniline dyes which are hydro carbon compounds of very complex chemical formulas. The discovery of this new world of color has opened hitherto undreamed of possibilities in the way of decoration. These aniline colors are known as aurine, a red dye-stuff fuschin, a magenta hue, aniline, green crystals, cochineal red, methyol-violet, or mauve, rosaniline or aniline red, aniline blue, iodine green, aniline brown and black, and a series known as scarlets and oranges. Eosin is an extremely brilliant red dye of great intensity, which is chemically known as the sodium salt of the sulpho-acid of tetro-bromic fluorescein. It is also styled tetrobromo-rescorcinphthalein and is sold from the laborary in the form of dark brown crystals which, when dissolved in water, form a red solution with a splendid green fluorescence. All these colors come in the form of crystals and powders which are dissolved in boiling water and precipitated by various mordants on a variety of bases such as clays, carbonates, hydrates and sulphates, as necessary vehicles for the application of the color by the artist, transforming the anilines into pulp colors. These have their own series of names such as Turkey red, French maroon, rose lake and rose pink, geranium lake, Bremen blue, Antwerp green, Rochelle red, orange lake, violet black, etc.

The manufacture of colors, both in the dry and pulp state, is a most interesting study. It depends on a wide knowledge of the secrets of nature, and a practical acquaintance with the exact processes employed to produce the desired results.

The following is a very brief list of the more prominent colors made:

BLACKS.—Bone black, ivory black, black lake and velvet black.

BLUES.—Cobalt blue, indigo blue, Bremen blue, steel blue, Prussian blue, ultramarine blue, purple lake and celestial blue.

BROWNS.—Burnt Turkey umber, raw Turkey umber, raw Italian sienna, Vandyke brown, brown lake.

GREENS.—Paris green, brilliant chrome green, banknote green, green lake, turquoise green, Malachite green, ultramarine green.

REDS.—English vermilion, Turkey red and Tuscan red, Indian red, Solferino lake, rose pink, Venetian red, carmine lake, crimson lake, carnation lake, scarlet lake.

YELLOWS.—Chrome yellow, golden ochre, orange ochre, French

ochre, Hoyt lake, Indian yellow, orange mineral, gamboge, Naples yellow, Japan orange, orange lake.

After the various colors are produced they are handled in the oil color mixing department, which is usually on the upper floor of the factory, so that when the ingredients used in the manufacture of paints are thoroughly combined, they are allowed to fall through the floor into the mills for oil color grinding on the floor below. A glance into the oil color mixing room discloses a range of ponderous machinery replete with every modern improvement for mixing oil colors. There is a ponderous array of shafting and cogwheels for turning the perpendicular shafts that mix the pigments and oil held in the receptacles below. The oil color grinding department on the floor beneath is filled with paint mills, and in each particular factory the mills vary in construction owing to the improvements and experiments made by the individual owners to improve the successful working of the mills. If the business be a large one several mills are kept running constantly the year round on one color; the consequence is that no waste is caused by changes from one color to another, with the additional advantage of the product possessing an exact and uniform tone and fineness. In grinding colors there is a great difference in consistency in the products, some colors coming out much stiffer than others. This is due to the difference in the character of the pigments in the different degrees of their susceptibility to the action of oil. Natural earths, containing more less grit, require to have the millstones set very close together to reduce the pigment to an impalpable fineness, while other pigments, being free from grit before entering the mill, will issue therefrom in a steady, even stream of semi-liquid consistency. After the paint is properly ground it is conveyed from the mills into long rows of large iron tanks on the floor below or storage department. The paint in these tanks is ready for filling into the various sized packages, and in large factories the filling or packing department is usually on the floor below the storage department. Pipes are connected with the various storage tanks, and in the packing department these pipes are attached to a peculiarly constructed straining apparatus, so that the paint goes into the packages perfectly fine and free from skins, dirt or other foul matter. This in fact is the busiest department in the entire factory. A large proportion of the paint goes into 50 gallon barrels, and the rest into an infinitely larger number of smaller packages. To facilitate the handling of a vast number of small packages filled in a large manufactory, there are small platform cars running on tracks which are easily moved to any part of the floor for sealing on the covers and labeling. When completed the cans are arranged each in its proper department of the storage room.

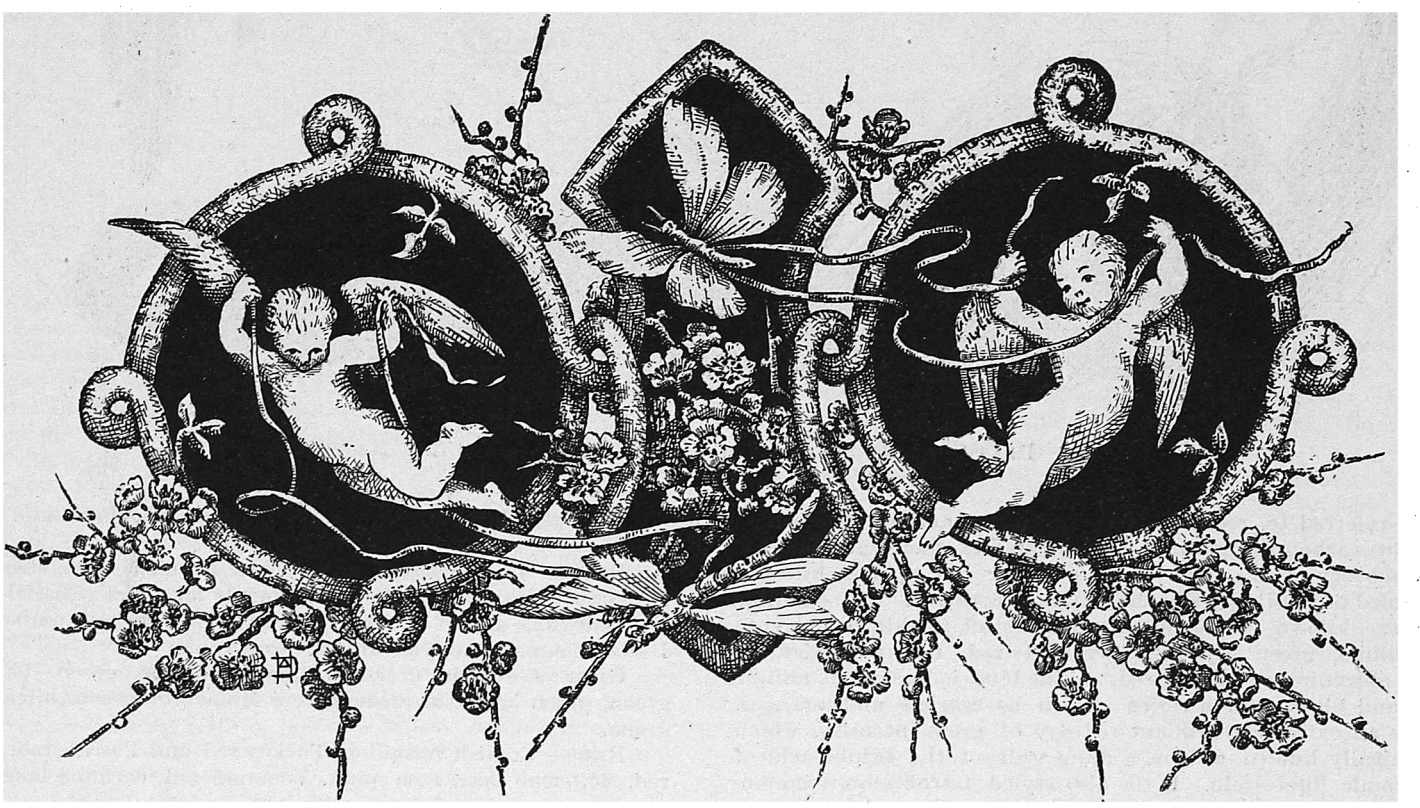
There are a number of auxiliary departments incidental to the manufacture of paints, the most important of which is, perhaps, the tin department, where are made all the tin packages made in the business. Here the tin, which is imported in plates, is handled entirely by machinery, the old time hand machines being entirely done away with. One of the most unique machines in the establishment, and one which illustrates what human ingenuity will do when forced by necessity, is the soldering machine. It is very interesting to watch the operation of such a machine, which does away with the slow and laborious process of soldering by hand, and usually has a capacity of fifty thousand cans per day of ten hours of the small sizes, and of large sizes proportionately less. It does its work automatically, and is adjustable to every size of can required to be put through it. Two or three boys only are required to feed it and remove the completed cans.

The labeling department is where the filled and sealed can of paint receives its finishing touches. This department of necessity includes the printing office, which nowadays is a necessary adjunct to a paint factory. It is here that the immense amount of stationery, advertising matter, labels, etc., are manufactured. It is no unusual thing to see seven or eight power presses at work not only on pamphlets and advertising matter but in producing colored labels that imitate in printer's ink the color of the paints themselves, and also the colored plates illustrating the application of colored paints to buildings. The labels are printed in large sheets and afterwards cut up and affixed to the cans of paint, giving them quite an artistic appearance.

Perhaps the most important department of all is the chemical laboratory, where the chemist of the factory examines and classifies his samples of various paints and colors, and determines the exact quality of the materials to be used, which is generally suggested by an analysis of the quality of the goods of his competitors. Here are seen lying around little squares of glass on which are thinly spread samples of various pigments, both in their raw and manufactured state, and this is one means of testing variations in tones and brilliancy.

In addition to ordinary paints there are departments for the manufacture of coach colors, drying colors, distemper colors, artist tube colors, pulp colors, etc. The products of a business of this kind fill a vast and increasing demand for paints throughout the entire country. The convenience and accessibility of such a product of universal demand to consumers everywhere is the direct cause of the enormous developement of the business. The professional painter purchases the materials of his paints by the barrel in an unmixed state and attends to the mixing of the paint himself, thereby effecting a saving in cost and obtaining a greater purity in the quality of his pigments. Ready mixed paint is, however, one of the principal branches of the business, and is alone a source of enormous profit to the manufacturer. The existence of ready mixed paints prompts thousands of men owning their houses to become their own painters, for with the necessity of having to mix his colors removed, the only secret of the professional painter has vanished, and under the present *regime* every man becomes his own painter.

A HANGING garden of sponge is one of the latest novelties house gardening. Take a white sponge of large size and sow it full of rice, oats or wheat. Obtain grains with the husks on them if possible. Moisten the sponge and place it in a shallow dish, and the seeds will begin to sprout before many days. When this has taken place, the sponge may be suspended by means of cords from a hook near the top of a window where a little sun will enter. It will become a living means of tender, delicate green, requiring a little occasional moisture.



DECORATIVE PANEL, BY HARRY A. DEANE.